Optimus Rotor Control replacement
High Speed / Dual Speed Rotor Control
versions 4512 104 7142x / 7146x / 7360x / 7361x / 7410X
replacement kits Optimus 9890 000 0268x

Before replacing a high speed rotor control unit carry out the following measures:

If breakers ENF1 / 2 / 3 tripped due to an unknown reason they should not be turned back on. First check:

1. Mains supply and distribution

- cut the generator from mains:
  - remove mains lines from the wall junction box (Optimus RAD = Bucky)

  or
  - turn off the room mains switch (Optimus R/F and C = Fluoro (+ Bucky))

- check at open breakers (off condition) that no contact is welded (Ohmmeter)

ENF1	L1 - T1	Optimus 50	2422 129 15514
	L2 - T2	*or successor*	*2422 129 16291*
	L3 - T3	Optimus 65/80	2422 129 15513
		or successor	*2422 129 16292*
ENF2	L1 - T1	Optimus 50/65/80	2422 129 00341
	L2 - T2	*or successor*	*2422 129 16288*
	L3 - T3		
ENF3	L1 - T1	Optimus 50/65/80	2422 129 15665
	L2 - T2	*or successor*	*2422 129 16508*
	L3 - T3		

- check that no contact of contactor ENK2 is welded (mechanical check: if snap-on auxiliary contacts or the aux. contact block can not be removed from the main contactor at least one contact is welded)

ENK2	phase 1	1 - 2	Optimus 50/65/80 contactor	2422 132 06621
	phase 2	3 - 4	+ 3 auxiliary contacts NO	2422 135 04355
	phase 3	5 - 6	+ 1 auxiliary contact NC	2422 135 04023
			or successor contactor	*2422 132 07381*
			+ succ. aux. contact block	*2422 135 04664*
			+ succ. R/C circuit	*2422 135 04661*

!! In case one of the contacts is welded the converter DC discharge time will be
!! much longer as the discharging auxiliary contact ENK2 41-42 cannot be closed.
!! (600V DC discharge time to < 60V DC approximately 40 **seconds**,
!! with open contact > **11 minutes !!** to be < 60V DC)

2.1. measurement of 2-phase U-V-W stator resistance ROT 350 housing

The stator coils might have caused the defect of the rotor control unit.

Measure the stator phase resistance (for all tubes connected) at the tube (disconnect the stator cable, all ***four links*** must be present and fixed)

phase U-V ***101/103*** - ***107/109*** normally 11 Ohms ± 1 Ohm
phase V-W ***208/210*** - ***202/204*** normally 9 Ohms ± 1 Ohm

If measured at the stator relays EWGX11/12 or the stator cable terminal EX1100 add the cable resistance (stator cable must be of screened type 0722 215 02054):

cable resistance	*(10m single length) + 0.27 Ohms*
(3 x 1.31mm^2)	*(15m single length) + 0.40 Ohms*
	(20m single length) + 0.53 Ohms

2.2. measurement of 3-phase U-V-W stator resistance ROT 504 housing

The stator coils might have caused the defect of the rotor control unit.

Measure the stator phase resistance (for all tubes connected) at the tube (disconnect the stator cable plug)

phase U-V ***XA pin1-2***
phase V-W ***XA pin2-3*** all must be 12 Ohms ± 10%
phase U-W ***XA pin1-3***

If measured at the stator relays EWGX11/12 or the stator cable terminal EX1100 add the cable resistance (see 2.1., stator cable must be of screened type 0722 215 02054).

3.1. measurement of 2-phase U-V-W stator inductance ROT 350 housing

It is not sufficient to measure the stator phase resistance only. The resistance measurement might pretend the stator coil is ok. A short-circuit of windings cannot be found with an Ohmmeter.
With an inductance meter (e.g. 4512 101 77141) measure at the tube or at the stator cable lines at the generator side (all ***four links*** must be present and fixed at the tube)

phase U-V ***101/103*** - ***107/109*** normally 57mH ± 10 %
phase V-W ***208/210*** - ***202/204*** normally 34mH ± 10 %

If the deviation is > ± 10 % the tube (stator = housing) must be replaced.

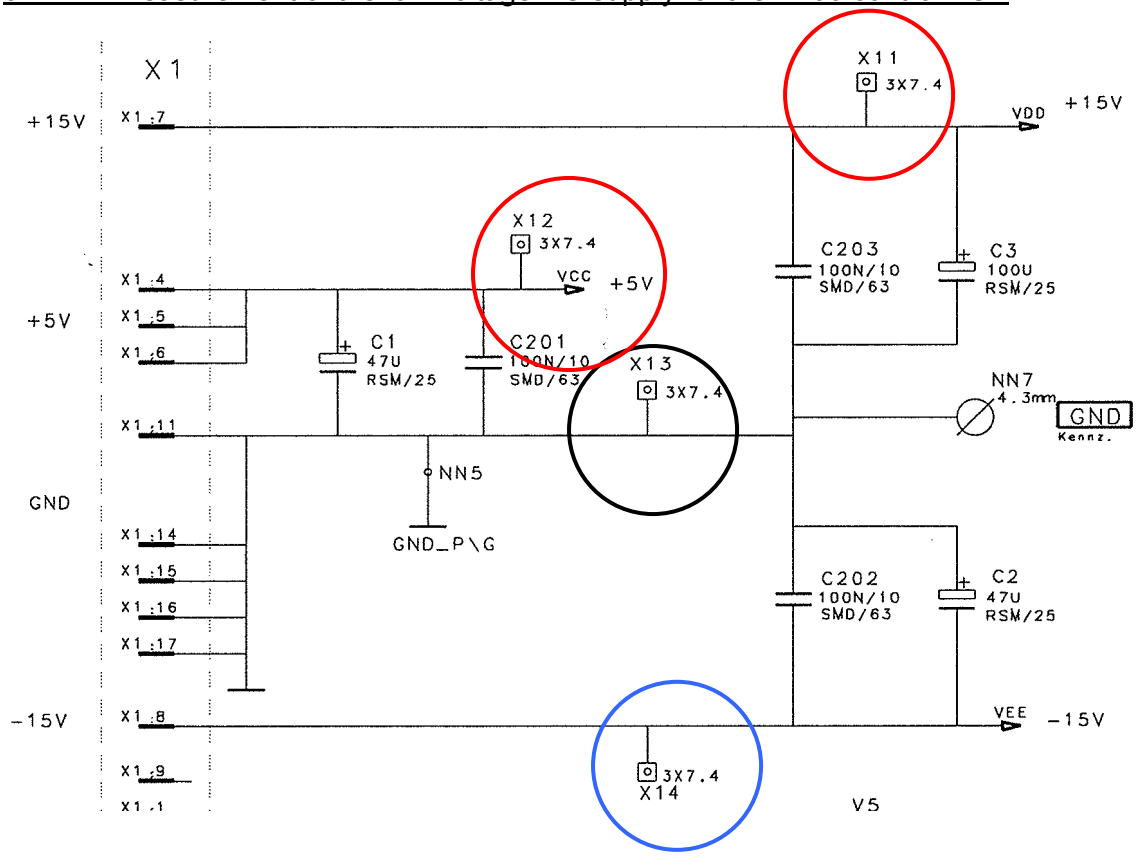
3.2. measurement of 3-phase U-V-W stator inductance ROT 504 housing

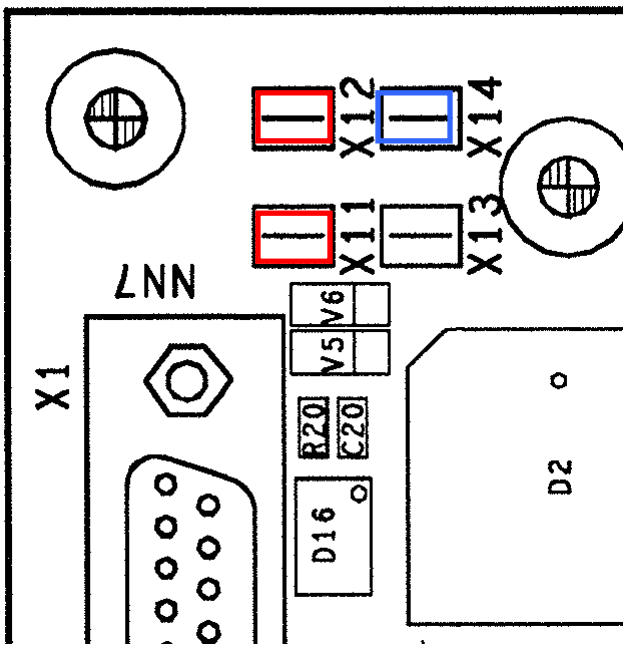
It is not sufficient to measure the stator phase resistance only. The resistance measurement might pretend the stator coil is ok. A short-circuit of windings cannot be found with an Ohmmeter.
With an inductance meter (e.g. 4512 101 77141) measure at the tube plug XA or at the stator cable lines at the generator side.

phase U-V ***XA pin1-2***
phase V-W ***XA pin2-3*** all must be 26mH ± 10%
phase U-W ***XA pin1-3***

If the deviation is > ± 10 % the tube (stator = housing) must be replaced.

3.2. measurement of the low voltage DC supply for the Y100 control PCB





4. first turn-on after rotor control 'event'

If chapters **1. ... 3.** are error-free
or
if parts of the mains distribution have been replaced:
Establish the mains cable at the wall junction box or turn the room mains switch back on.

Turn on all breakers **except ENF3 !** for the rotor control mains supply.

Reason: If the generator had been in preparation condition and had been cut from mains during a fuse trip the CPU memorizes that it did not send a brake command.
CU will send it during the start-up phase at the next turn-on.
CU does not get and does not wait for a brake confirmation of RoCo.
To be on the safe side and to prevent from further damage the brake command should take place without any power for the RoCo drivers, therefore ENF3 should be off.
The generator will display an error message 10LU = intermediate DC out of range (on the desk and/or on the service PC if online) due to the missing power supply (ENF3 off).

If the error does not clear by itself push the "RESET" labeled button on the control desk.

If the generator comes to a standby ready state (check the system ready conditions of if not) proceed to the tube extension unit WG chapter **5.**.

If a WG unit is not present, proceed to chapter **6.**.

5. tube extension unit EWG check

The breaker ENF3 should still be off, but the generator be on.

Check that one of the stator relays EWGK11/12 is energized
(old version relays = small brown indication pin **not** at left edge of the slit)
(*new version relays = brown indicator pulled inside*).
The contactor must not be activated manually.

The contact resistance cannot be measured with a regular Ohmmeter as the small current of the meter pretends a very high resistance (as a matter of the silver plated contact area).
It must be measured invasive with at least 2 A passing the closed contact. As the contact should have a typical resistance of < 0.1 Ohm, the voltage measured via the contact should not increase 0.2 Volt (with 2A).

EWGK11	phase U	1 - 2	relay	2422 135 03942
	phase V	3 - 4	*successor relay*	*2422 132 07379*
	phase W	5 - 6		
EWGK12	phase U	1 - 2		
	phase V	3 - 4		
	phase W	5 - 6		

If the measured value is higher, exchange the relay.

6. replacement of rotor control unit

Switch off the generator with ENF1 or with the room mains switch.

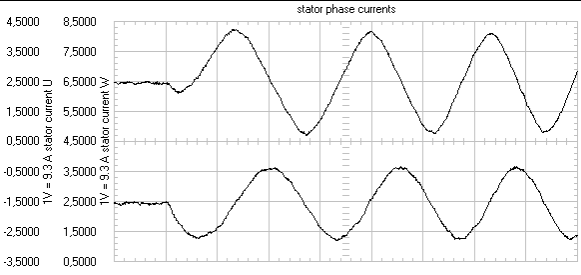
If chapters **1. ... 5.** are error-free or parts have been replaced, exchange rotor control unit:
4512 104 7142x for generators with **CU release 3.x RAD + R/F** and **1.x Optimus C**
4512 104 7360x and **7361x** ditto
4512 104 7146x and **7410x** for generators with **CU release 2.x**.
The new units 4512 104 7142x/46x/7360x are already equipped with firmware 4512 113 22322/3.
Units 4512 104 7361x/7410x are equipped with firmware 4512 113 22341.

Optimus RAD Release 2.x generators:
It is sufficient to replace the unit.
Turn on ENF3. Turn on the generator and check all functions.

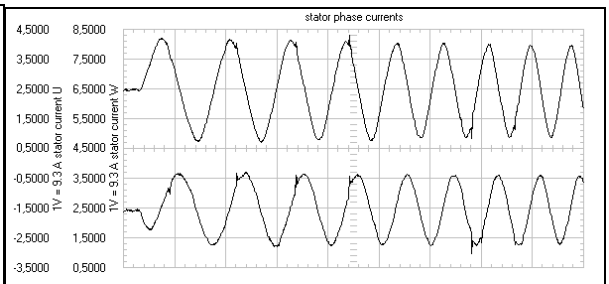
Optimus RAD + R/F Release 3.x generators:
Turn on ENF3. Turn the generator on.
The generator might come up with error messages 10LU and 10TD.
Reload the tube data for all installed tubes from file **TUBE_R3.TDL** (file size 154.224B, date 20.02.2004), previous versions don't work.
Carry out adaptation. Check all functions.

Optimus C Release 1.x generators:
Turn on ENF3. Turn the generator on.
The Cockpit might come up with a generator error message.
In case that the error log index of the generator shows 10LU and 10TD:
Reload the tube data for all installed tubes from file **TUBE_R3.TDL** (file size 154.224B, date 20.02.2004), previous versions don't work.
Carry out adaptation. Check all functions.

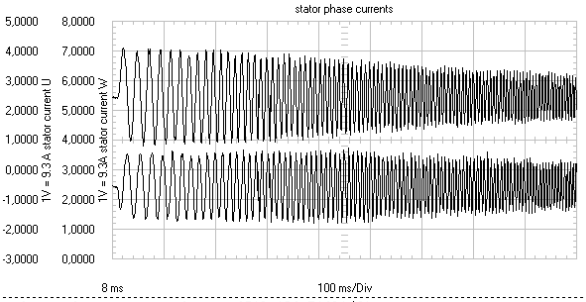
Chokes or additional NTC's which have been added to the previous Rotor Control unit (via FCO's) must not be mounted to the new unit.
The entire old unit must be discarded.
It must be disposed of in accordance with the local environmental regulations.



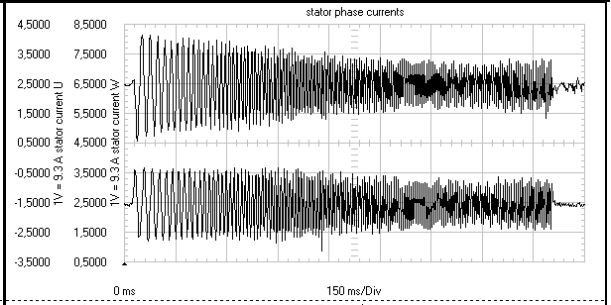
High Speed Rotor Control unit 4512 104 71421/61
start of acceleration phase with SRO25/51 ROT350
stator phase U = Y100 X15 = 15.6A = upper signal
stator phase W = Y100 x17 = 11.3A = lower signal
DC offset at measuring points X15/17 + 2.5VDC against ground
start frequency 42Hz rdrchs_1.pcx



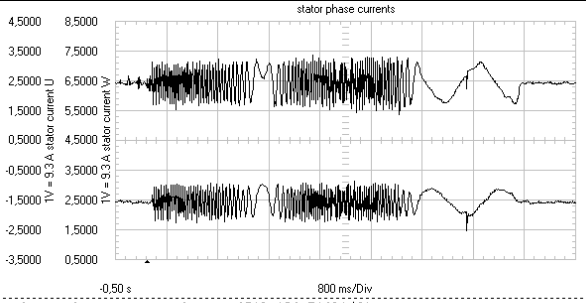
High Speed Rotor Control unit 4512 104 71421/61
start of acceleration phase with SRO25/51 ROT350
stator phase U = Y100 X15 = 15.6A = upper signal
stator phase W = Y100 x17 = 11.3A = lower signal
DC offset at measuring points X15/17 + 2.5VDC against ground
rdrchs_2.pcx



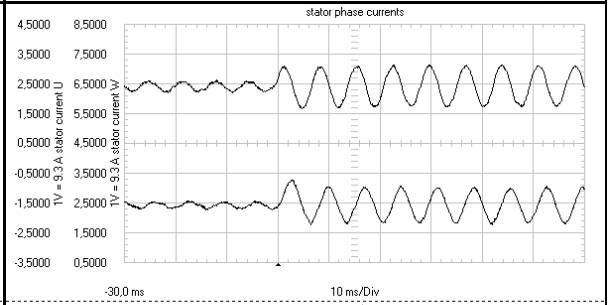
High Speed Rotor Control unit 4512 104 71421/61
acceleration with SRO25/51 ROT350
stator phase U = Y100 X15 = 15.6A start and 7.6A at 850ms = upper signal
stator phase W = Y100 x17 = 11.3A start and 8A at 850ms = lower signal
DC offset at measuring points X15/17 + 2.5VDC against ground
rdrchs_3.pcx



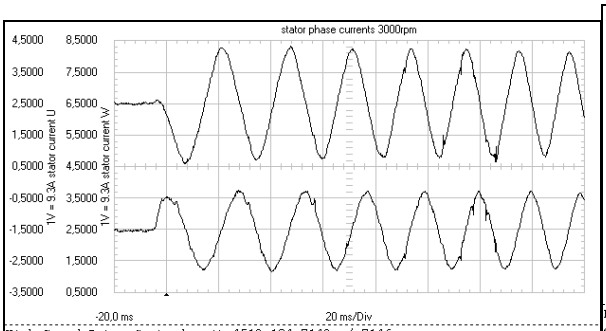
High Speed Rotor Control unit 4512 104 71421/61
acceleration phase with SRO25/51 ROT350 = 1240ms
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/17 + 2.5VDC against ground
rdrchs_4.pcx



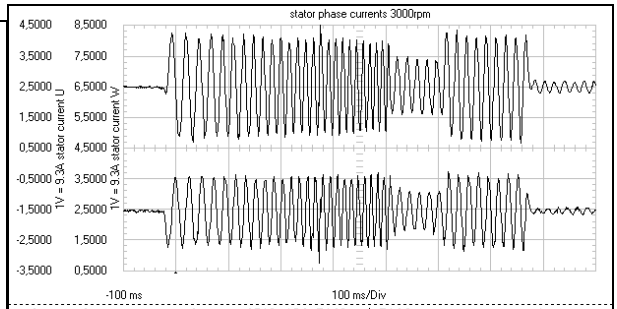
High Speed Rotor Control unit 4512 104 71421/61
braking phase = 5.8 seconds, 1Hz frequency at brake end, SRO25/51 ROT350
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 X17 = lower signal
DC offset at measuring points X15/15 + 2.5VDC against ground
rdrchs_5.pcx



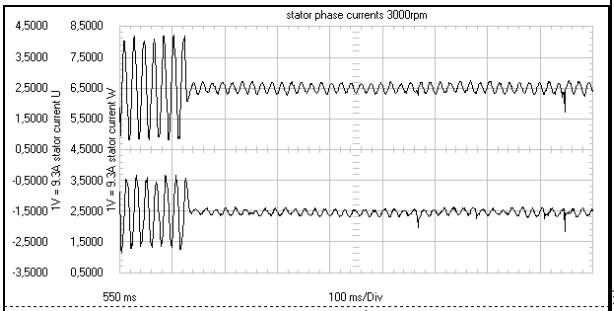
High Speed Rotor Control unit 4512 104 71421/61
start of braking with a frequency of 140Hz SRO25/51 ROT350
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 X17 = lower signal
DC offset at measuring points X15/15 + 2.5VDC against ground
rdrchs_6.pcx



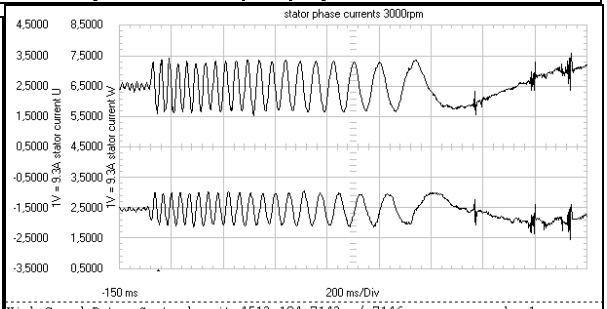
High Speed Rotor Control unit 4512 104 7142x / 7146x
rotation start 3000rpm RO17/50 ROT350
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/X17 +2.5VDC against ground
ro_star1.pcx



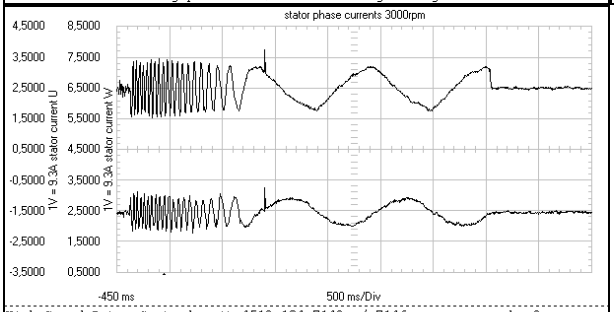
High Speed Rotor Control unit 4512 104 7142x / 7146x RO_acc1.pcx
entire acceleration to 3000rpm with transition to continuous rotation
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/X17 +2.5VDC against ground
(ignore the strange waveform in the last third of the picture, it is a matter of signal and oscilloscope sampling rate interference)



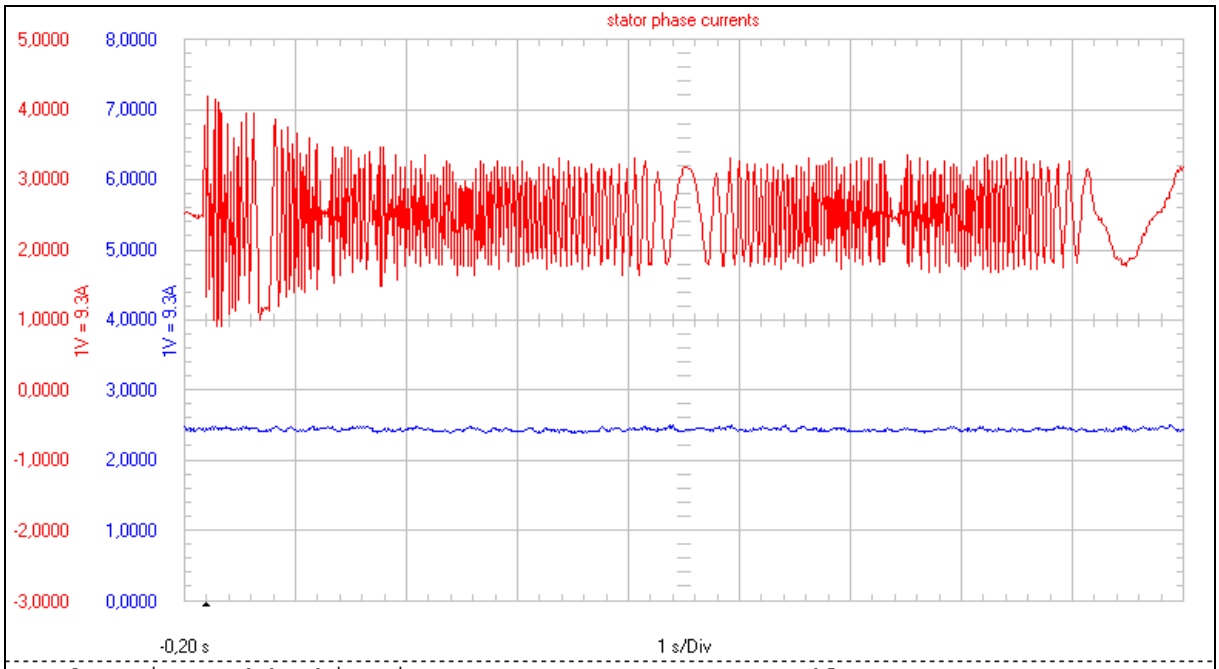
High Speed Rotor Control unit 4512 104 7142x / 7146x RO_acc2.pcx
rotation acceleration end and transition to continuous rotation 3000rpm
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/X17 +2.5VDC against ground



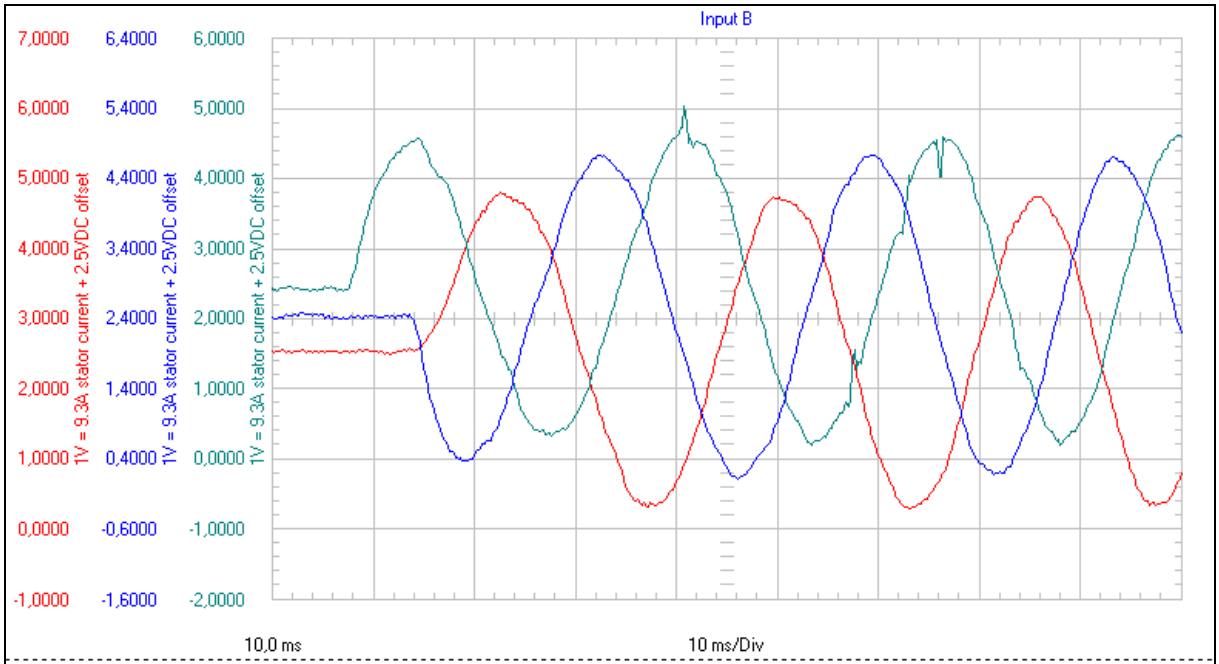
High Speed Rotor Control unit 4512 104 7142x / 7146x ro_bra1.pcx
transition continuous rotation to start of braking 3000rpm
start frequency for braking = 30Hz
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/X17 +2.5VDC against ground



High Speed Rotor Control unit 4512 104 7142x / 7146x ro_bra2.pcx
transition continuous rotation and braking from 3000rpm down to zero rpm
start frequency for braking = 30Hz, f = 1Hz at the end of braking
stator phase U = Y100 X15 = upper signal
stator phase W = Y100 x17 = lower signal
DC offset at measuring points X15/X17 +2.5VDC against ground



acceleration and braking in one turn 10LL_err.pcx
in case of stator current problems detected in one of the stator phases
causing error display 10LL
ch1 = red = stator phase U
ch2 = blue = stator phase W (stator line disconnected)



ch A = Y100 X15 stator phase U
ch B = Y100 X16 stator phase V
ch C = Y100 X17 stator phase W
external trigger EN_X_C/ EZX76
preparation, acceleration start
start frequency 38Hz = 2300rpm
ROT504 3-phase rot504_06.pcx